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ABSTRACT

This report focuses on several reasons for questioning the appropriateness of the standard measures of returns to education in deciding about education programs and evaluating their comparative advantages vis-a-vis other investments in developing countries. The goal is to provide some guidelines in selecting future research options in the field of education and development. This paper concentrates on two sets of issues arising on the "demand side" of education. The first is concerned with the demand for education by households, and with the demand for educated labor by the productive sector of the economy. The second issue focuses on the public, or "collective," aspect of the returns to education and is more speculative. The first of two parts of this document summarizes the mechanics of "educational transition" as this transition could be derived from a competitive model integrating the labor market and educational system. This general framework provides a reference to evaluate the biases that result from adopting a static or stationary approach to the measurement of educational returns. Explained are how the shortcomings of this approach can be overcome by several research orientations. The remaining part of the paper addresses issues linked only to purely productive externalities, the fundamental issue being that of identifying them empirically. Several research directions are investigated, one of which relies on the well-known Solow-Denison macroeconomic framework. An attempt is made to show the important analytical potential that lies in the availability in many countries of repeated cross-sectional surveys on earnings, occupation, and schooling. (40 references) (RR)

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Issues and methodologies in educational development:

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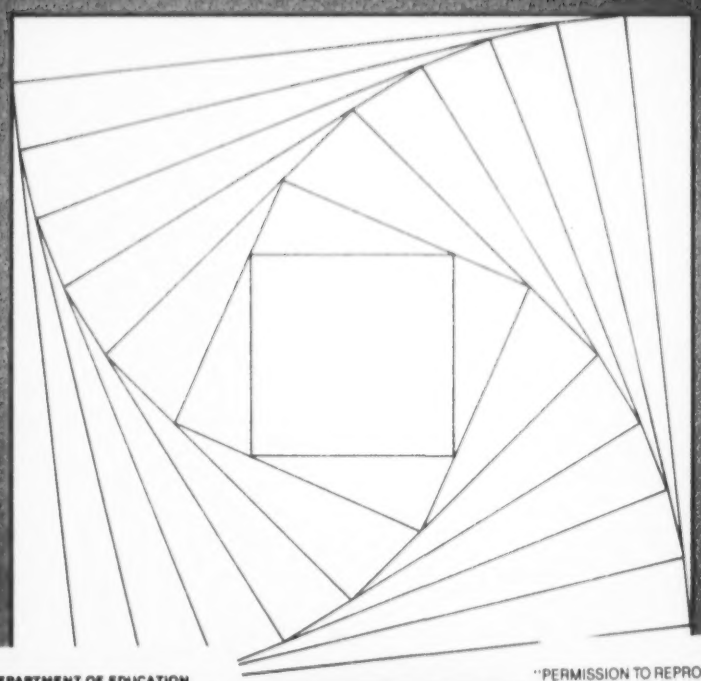
Education and development: some research directions

F. Bourguignon C. Lang



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Issues and methodologies in educational development:
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Education and development: some research directions

François Bourguignon Christine Lang

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Chapter I

Introduction

Considerable work has been accomplished by economists and other social scientists over the past 20 or 30 years to understand and measure the role of education in the development process. Directly or indirectly inspired by the so-called human capital approach, that work has largely concentrated on measuring the private and social return to formal education, and on the technical means to raise it. The present paper will not attempt to review the voluminous and important literature on this subject -- this has been partly done by several authors, see Psacharopoulos (1987) in particular. Instead, it focuses on several reasons to believe that the standard measures of the 'return to schooling' may be inappropriate in deciding about educational programmes and evaluating their comparative advantages vis à vis other investments in developing countries. This reflection is meant to provide some guidelines in selecting future research options in the field of education and development.

Leaving aside the purely technical aspects of the 'production' of education, that is the 'supply-side' of the schooling system, the paper concentrates on two sets of issues arising on the 'demand side' of education. The first is concerned with the demand for education by households, and with the demand for educated labour by the productive sector of the economy. The argument in that part of the paper essentially rests upon the obvious fact that, still less in developing than in developed countries, the implicit assumption in most of the literature that the market for education and educated labour is in a permanent supply-demand competitive equilibrium is untenable. Over the past 30 years, most developing countries have witnessed huge changes in the structure of their educational system, of their economy and of their society. Changes are still under way so that evaluating the long-run development impact of education requires correcting available data from what may be purely transitory effects.

In countries where primary or basic secondary enrolment rates are still below 100 per cent, for instance, selection mechanisms into the educational system are likely to be at work which may introduce severe biases in the measure of private and social returns to schooling. Likewise, if one believes that the short -- and medium-run substitutability between less and more educated individuals in the labour market -- and between young, mature and old workers -- is limited, then the higher education of younger generations may result in an overall structure of earnings which does not accurately reflect the private and public productivity of education, and which may, in turn, affect the private demand for education.

Examining those issues requires taking a more comprehensive view at what we could call the 'educational transition' in developing countries. In particular, it requires adopting a dynamic framework where both the market for education -- i.e. the selection into the educational system -- and the market for educated labour would be fully integrated. This stands in obvious contrast with most of the existing literature which takes an essentially

static point of view at the micro level -- e.g the large predominance of cross-sectional studies -- and an overly aggregated perspective when considering dynamic issues.

The second part of the paper focuses on the public, or 'collective' aspect of the returns to education and is more speculative. The idea there is that education may not only enhance the ability of individuals to generate more income, and possibly more output, but also to contribute 'externally' to the development process by modifying individual behaviour in areas like fertility, the diffusion of knowledge, the determination of preferences, or the exercise of democracy. The analysis follows closely the recent revival of the 'endogenous growth' theory, where the natural limit to growth coming from the fixity of labour may be overcome by positive externalities arising from education and responsible for a permanent increase in the overall productivity of labour.

Various issues arise in that context. First, it must be empirically determined whether, indeed, such externalities exist, and, if so, what their size may be. Second, an implicit price should be given to them that would correct direct estimates of public returns to education. No detailed methodology is proposed here, but several possible research orientations are suggested which might be fruitfully investigated.

Chapter II

Measuring educational returns during the 'educational transition'

Most of the theoretical and empirical literature on the returns to education is 'static'. Indeed, theory mostly refers to stationary equilibrium situations, whereas most empirical studies bear upon cross-sectional data. In countries where the educational structure of the labour force is changing rapidly because of the increasing availability of educational facilities, such an approach may be quite misleading. It is very unlikely that the market for labour be permanently in equilibrium. Thus, successive cross-sectional studies of a population will probably show rather different pictures, the interpretation of which may be unclear.

The first section of this part of the paper summarizes the mechanics of the 'educational transition', as it could be derived from a comprehensive model integrating the labour market and the educational system. This general framework provides a reference to evaluate the biases arising from adopting a static or stationary approach to the measurement of educational returns. This is done in the second section, whereas the third section proposes several research orientations which should permit to overcome part of the shortcomings of the static approach by exploiting in a rigorous way the repeated cross-sectional surveys available in many developing countries.

1. The dynamics of the educational transition

Consider the case of a country where a very rapid development of education is taking place, induced by a powerful growth of publicly provided educational facilities.[1]

This process may have two important consequences. First, the enlargement of the pool of secondary educated persons may imply some changes in their mean characteristics. This will be the case if the selection into the schooling system was initially biased with respect to those characteristics. Other things being equal, the mean return to schooling for these cohorts may thus be modified. Second, the entry of these cohorts in the labour market may produce a drastic change in the educational structure of the labour-supply, which in turn may induce changes in the structure of earnings by educational levels, and therefore changes in the observed returns to education. In turn, those changes may modify the expectations of parents regarding the future earnings of their children, and, where school enrolment is not

1. In Colombia, for instance, the share of individuals with secondary education in the 15-18 age bracket rose by 20 per cent between 1975 and 1985, whereas secondary enrolment increased by 63 per cent.

100 per cent, the selection process into the schooling system. We consider successively these three aspects of the educational transition.

(a) The selection into the schooling system

Not all children in a society attend school for the same number of years, and even though schooling may be compulsory in some countries for a substantial number of years, not all children complete the whole cursus. As soon as shooling ceases to be compulsory, the choice arises for parents of keeping their children in school or sending them to work. This selection into the schooling system -- which may appear very early in countries which do not have yet completed universal primary education -- is certainly not random, so that any increase in enrolment rates is likely to correspond to a change in the mean characteristics of the population that is enrolled.

For expository purposes we may consider that this selection process corresponds to some kind of 'educational market', even in countries where private schools are inexistent. Public schools with a given capacity at a point in time are on the supply side. Families are on the demand side, with parents deciding about whether to send a child to school on the basis of several variables: direct and indirect (foregone earnings) costs, family income, expectations about schooling returns, etc.. Registration in public schools being generally free, the educational market behaves like all other markets with fixed prices. Some lasting disequilibrium may arise between supply and demand. The nature of the disequilibrium to a large extent determines the selection process into schooling.

In case of an excess supply (or at equilibrium), the selection process depends only on family and children characteristics. This is the familiar 'path' model found in the literature.[2] The number of years of schooling, and/or the grade attained, is explained by family variables (occupation of parents, income, family composition, etc..), the cost of schooling and the child's ability, which itself may be explained by another combination of family variables.

In case of an excess demand, things are slightly different. Some rationing occurs according to a scheme that may not be transparent. The most common scheme is geographical: public schools are located in specific areas and the cost of schooling is prohibitively high for those families living far from them. Rationing may also proceed on the basis of students' ability -- e.g. the selective examinations to pass to the superior grade. It may also be performed on the basis of family characteristics, school acting then as a social screening device. It is not difficult to account for the first rationing scheme when estimating the private demand for schooling. It is simply a matter of including in the statistical analysis, along with family characteristics, some variables describing the availability of educational facilities[3]. Where no direct observation is available on ability, however, it is obviously not possible to distinguish between the last two schemes.

2. Numerous models of that type have been estimated in developed countries. For developing countries, see for instance Jamison and Lockheed (1987), Psacharopoulos (1990), Rosenzweig and Evenson (1977).

3. This is done for instance in Jamison and Lockheed (1987), Gertler and Glewwe (1989). Note also that these variables should normally describe the quantitative as well as the qualitative constraints on available schooling.

This ambiguity raises serious problems when one takes a dynamic view at education. In the case of initial rationing, any increase in the supply of educational facilities will necessarily increase enrolment. But, depending on the rationing scheme, it will also modify the average characteristics of those attending schools. If rationing is initially based on ability, educational expansion will result into a drop in the mean ability of graduates. On the contrary, if rationing is initially based on other characteristics, the mean ability may not be affected, or may conceivably increase. This may be of extreme importance when evaluating, a priori, the social benefits of expanding the educational system.

The situation is different where the educational market is initially at equilibrium, or in excess supply. The expansion of the educational system may then be seen as resulting from a change in mean family characteristics or in their distribution. Economic growth, for instance, generates an income effect which may lead families to invest more in the education of their children. Likewise, changes in the expected future earnings of an educated child -- i.e expected returns to education -- or in the cost of education are likely to produce substitution effects on educational investments. However, the resulting expansion of enrolment rates may not be totally neutral with respect to the distribution of abilities in the enrolled population. This will be the case only if income and price effects are independent from ability, which, as noted above, is rather unlikely.

It follows from the preceding arguments that a deep understanding of the effects of an expansion of the educational system requires identifying what is the initial regime of the educational market at the various educational levels and then a good knowledge of the way selection operates on both sides of the market. The main point made above is that any change in enrolment, is likely not to be *neutral* in terms of the characteristics of enrolled individuals. The earnings performances of a given cohort on the labour market, and thus the observed returns to education, are likely to be sensitive to these variations in schooling attainments and the implicit changes in selection behind them. Understanding this phenomenon requires expanding the few empirical models of schooling determinants, presently limited to a few developing countries, both geographically by covering a larger set of countries, and temporally by re-estimating the same models at various points in time.

(b) Relative earnings and labour market behaviour

Changes in the educational achievements of cohorts entering the labour market are also likely to result in temporary and permanent changes in the structure of earnings, and thus on measured returns to education. It is not inconceivable for instance that a sudden inflow of basic secondary school graduates bring about a fall in their earnings, relative to that of primary educated workers, below their long-run equilibrium level.

Let us consider a fully aggregate framework, and let us assume that on the production side of the economy substitution is imperfect between workers with distinct educational levels, and workers with distinct work experiences.[4] If the labour market were clearing

4. This is a central assumption in all Tinbergen's work on the subject. See Tinbergen (1956), (1970), (1972).

instantaneously, an expansion of the educational system would result in the following sequence of changes in relative earnings. First, the fact that the youngest cohort stays longer at school than before leads to a fall in the share of young low-educated workers in the labour force. This is in turn should produce an increase in the average level of wages throughout the labour force, this increase being more pronounced for the group of workers in scarce supply, that is low-educated young workers. The second stage of the transition is when the cohorts with additional schooling enter the labour market. If labour force participation is not modified, the growth the overall labour force resumes at its previous rate and the overall pressure on wages disappears. In relative terms, however, high educated young workers are more numerous than before. Competitive mechanisms should then lower the relative earnings of that group. If there is no response to that drop in educational returns by the private demand for education, it will be passed on to the following cohorts. After some time, the relative earnings of more educated workers will be lower in all age groups than before the educational expansion.

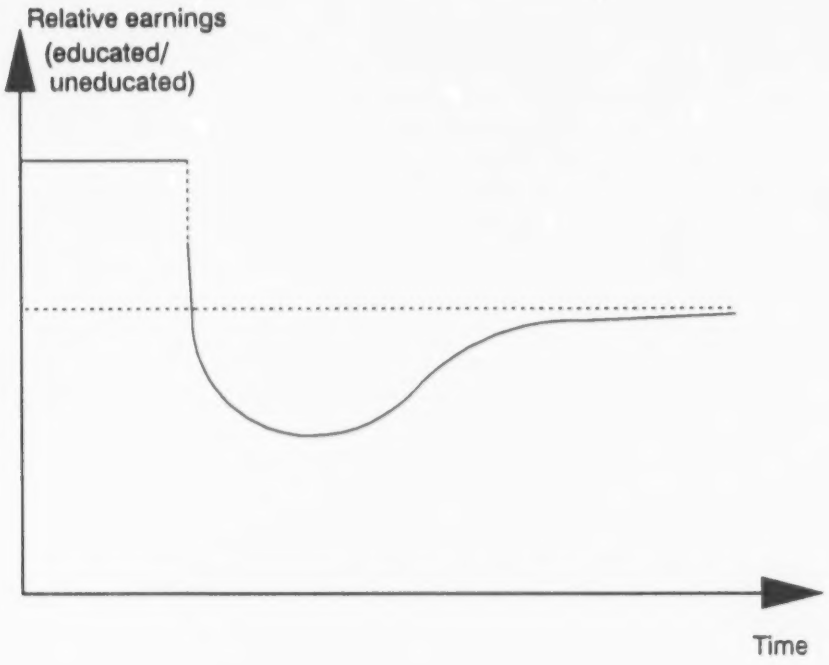
Several factors may modify that scenario. First, with unchanged wages, the rise in the average level of education of younger cohorts may result in an increase in labour force participation when leaving school. This phenomenon is particularly pronounced for women in most developing countries beyond some stage of economic and educational development. The effect will thus be a further depression of wages and of the relative earnings of young educated workers, which in turn may temper the initial increase in labour-supply by that group.

Second, the substitution between workers with different educational levels may be very low in the short-run. If this is the case, entrants in the labour market with a higher level of education will not find enough jobs. A typical rationing situation will result. Some workers will be temporarily unemployed -- e.g. the well-known 'youth unemployment' phenomenon observed in several developing countries despite satisfactory growth rates. Others will possibly leave the labour force, whereas still others will accept jobs initially filled by less educated workers, in accordance with the well-known 'job competition model'.[5] Competitive pressures on available jobs for more educated workers will also lower earnings rates in those jobs. In the short-run, then, the effective average earnings of more educated entrants in the labour force may prove to be considerably lower than what was observed before the educational expansion.

With time and because of the drop in the relative earnings associated with jobs requiring more educated workers, some substitution will take place on the demand side of the labour market. Rationing will become progressively weaker, and relative earnings will tend toward their long-run equilibrium value. The actual time-path of the earnings of the more educated relatively to the less educated workers may take various shapes, depending on the relative speeds of the wage adjustment and the substitution processes. A U-shape of the type depicted in *Figure 1* is not inconceivable.

5. See Thurow (1975).

Figure 1. Earnings differential during an educational transition



A third factor affecting the evolution of relative earnings following a rapid expansion in education is precisely the fact noted in the previous section that such an expansion is likely not to be neutral in terms of those individual characteristics which may affect earnings, independently from schooling. So, even in the absence of labour market reactions to the increased supply of more educated workers, any expansion of the educational system may modify the *apparent* returns to education, as measured by relative earnings between various educational groups. This change may be only apparent because the actual returns to education might well prove unchanged if it were possible to account for the variations in the mean non-educational individual characteristics of the workers.

It is not clear how important the preceding changes in the earnings structure of the labour force may be. Only a few attempts have been made in the literature at estimating the reaction of the labour market to strong modification in the size and the structure of the incoming labour force. In the case of the United States, Welch (1979) has shown that the entry of the baby-boom cohort in the labour force between 1967 and 1975 had significant negative effects on the relative earnings of that cohort. However, although it had on average more schooling than the preceding cohorts, no significant variation in relative earnings by educational levels was observed. Things may be quite different in developing countries which are still quite far from full primary and secondary enrolment and where changes in the educational structure of the incoming labour force are much more pronounced.

(c) Feedback effects on the demand for education

It is conceivable, at least in theory, that an observed drop in the returns to schooling of cohorts entering the labour force have a negative impact on the household demand for education. Lower expected returns to schooling in preceding cohorts may discourage parents to keep their children in school beyond the compulsory age. If the educational market was initially in a situation of equilibrium or excess supply, enrolment rates will fall[6]. If it was in a situation of excess demand, enrolment rates will possibly remain the same, but the mean characteristics of the enrolled population may change because some part of the population will not be interested anymore in sending their children to school. Some of the effects analyzed in the preceding sections might then be reversed.

The natural question to ask at that stage is whether the preceding movements may converge toward some equilibrium and how long it might take. Under one form or another, the well-known Beckerian model, that is the theory of compensating wage differentials, gives a simple positive answer. The long-run equilibrium must be such that all individuals should be indifferent between the various levels of schooling they may choose. Assuming a perfect capital market and no other cost to schooling than foregone earnings, earnings at equilibrium should grow with the number of years of schooling at a rate equal to the interest rate.

Of course, such an equilibrium corresponds to the ideal case of a fully efficient economy in a steady state of growth. It may never be reached, or it might take several generations to reach it. Under these conditions, the common procedure which consists of estimating educational rates of returns on the basis of cross-sectional data and comparing them to the rate of interest to justify more or less educational investments is likely to be quite misleading. Because it is based on an inappropriately static view of the world, such a procedure is bound to yield biased measures of educational returns.

2. Problems in the measurement of educational returns in periods of transition

Private (public) returns to schooling at different educational levels for a given cohort are usually measured by the relative differential in the mean earnings of workers at two successive education levels, corrected by the direct private (and public) costs of education. Ignoring these costs, an estimate of the average return to schooling is provided by the coefficient, r, of schooling in the semi-logarithmic regression:

$$\text{Log } w_i = r.S_i + a.E_i + b.E_i^2 + u_i \qquad (I.1)$$

where w_i is the earnings of an individual i, S_i his/her level of schooling, measured in completed years, E_i his/her work experience and u_i a disturbance term picking up the effect

6. The opposite may also occur. For instance, the obvious difficulties of the youth labour market in the 1970's and the 1980's in Europe has led some individuals to stay in school to get a better training that was expected to eliminate the risk of unemployment.

of omitted earnings determinants. In that 'Mincerian' equation, the introduction of work experience is meant to take into account the individual strategies of further human capital accumulation by working individuals, the square term accounting for the fact that the benefit of such accumulation diminishes along the life-cycle. This also permits to correct observed earnings for obvious age effects when estimating the effects of education on earnings simultaneously on various cohorts of individuals at a given point in time.

Model (I.1), or more sophisticated measures of educational returns, are generally estimated on cross-sections of individuals in the labour force.[7] However, there are several reasons to believe that the resulting estimates generally are biased.

In line with our argument about the selectivity of the educational system in the preceding section, it is clear that the conventional ordinary least squares estimate of r in regression (I.1) is necessarily biased if some of the omitted variables, the effect of which is summarized by the disturbance term u_i, are correlated with the level of schooling attained by an individual. Indeed, in such a case, there is a risk of attributing to schooling an effect on earnings which is not the result of schooling per se but of individual attributes which have determined in the past the formal education acquired by an individual and are simultaneously determining his/her current level of earnings. The resulting bias, which was first noticed by Griliches (1977), may be corrected by 'instrumenting' the schooling variable in (I.1), or more directly by replacing the initial equation by a system of equations where earnings and schooling are explained simultaneously. Where additional individual characteristics, like ability or cognitive knowledge, are available, these variables may also be introduced according to some reasonable causation chain.

As an illustration of these 'path' models, the earnings model estimated recently for Colombia by Psacharopoulos and Velez (1990) takes the following recursive form:

Ability = A (sex, father's schooling) (I.2)
Schooling = S (sex, father's schooling, ability) (I.3)
Cognitive achievement = C (sex, father's schooling, ability, schooling) (I.4)
Earnings = E (sex, father's schooling, ability, schooling, cognitive achievement) (I.5)

This model is estimated on a cross-section of 30-years old workers, with direct measures of ability (Raven test) and cognitive achievement (based on another set of tests).[8] The estimated average return to an additional year of schooling obtained with specification (I.5) proves to be approximately 2 percentage points below that obtained with specification (I.1), which ignores ability and family background variations across individuals.

7. A few estimates based on panel data are also available. On that point, see the short survey by Atkinson, Bourguignon and Morrisson (1988).

8. Note that the 'triangular', or recursive nature of the model dispenses using simultaneous equation techniques, or instrumenting the endogenous variables, at the estimation stage.

Models of that type have been estimated in several developing countries (Nepal, Philippines, Kenya, Korea, Tanzania, Colombia, ...)[9]. Some models include more detail on the selection process into the educational system -- equation (3) above. They include in particular family income, travel time to the nearest school, quality of the school described by the teacher/pupil ratio, family composition, sibling order, etc. (see for instance Jamison and Lockheed (1987), Gertler and Glewwe (1989)).

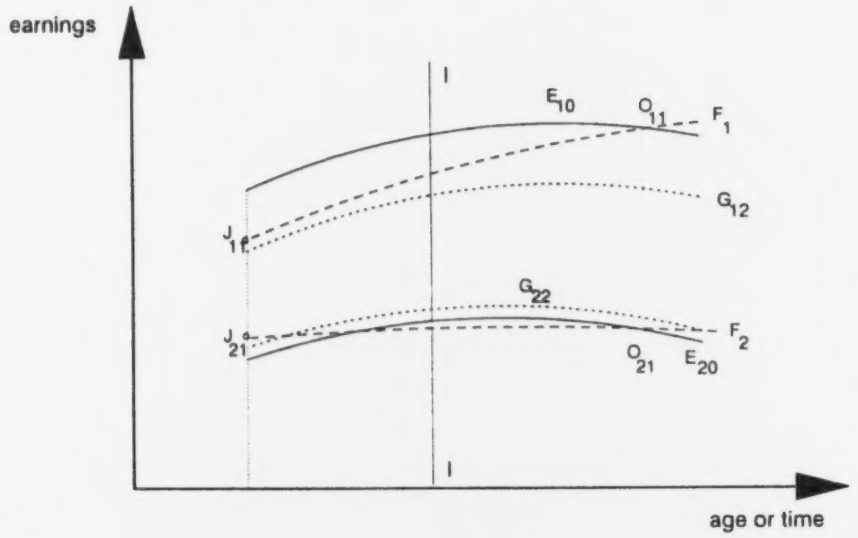
We now consider the adequation of the preceding estimation techniques to countries where education is increasing rapidly among young cohorts. The first difficulty is that the implicit stationarity assumption behind the preceding models cannot be sustained anymore. This means that repeated cross-sectional estimations of the returns to schooling may give a wrong idea of the true evolution of that variable over time. *Figure 2* illustrates that point. The two solid curves (E_{10}) and (E_{20}) correspond to the life-cycle profile of earnings for two educational levels (1 and 2) in a reference steady-state (0) of the economy. Assume now that the youngest cohorts have a much higher average level of education than the older ones, which implies a drop in the relative earnings of the more educated workers in those cohorts. However, because of the imperfect substitution between workers at different ages this change in relative earnings is not passed on to older generations. At time 1, we observe the earnings of young workers at points J_{11} and J_{21} for the levels of education 1 and 2, which are respectively above and below the initial stationary life-cycle profiles (E_{10}) and (E_{20}). The old workers at time 1 are still on the latter profiles at points 0_{11} and 0_{21} respectively.

We notice first that when estimating a model of type (1) on the cross-section of earnings observed at time 1, the estimated life-cycle profile of earnings will prove steeper than the initial profiles for more educated workers, and flatter for less educated workers[10]. These estimated profiles correspond to the curves labelled respectively (F_1) and (F_2). Second, the estimated return to education will be given by the distance between the two latter curves at the middle point of the graph (line II) -- i.e. the mean of the earnings differential in the young and the old generation. A comparison of the two cross-sections at times 0 and 1, will thus lead to the conclusion that the return to education has fallen, although by less than what could be inferred from considering the youngest cohorts only, and that the return to work experience has increased for more educated workers and decreased for less educated workers.

9. On the countries mentioned, see Jamison and Lockheed (1987), Knight et al. (1981), Knight and Sabot (1987), Lilliard and King (1987), Kann (1978), Chernichovsky (1985), Psacharopulos and Loxley (1985).

10. Note, however, that they are assumed to be the same in model (I.1).

Figure 2. The dynamics of earnings and education



The bias in those conclusions arises from the fact that they are derived from the assumption of stationarity in a situation which is purely transitory. If we could take a new cross-section 15 or 20 years later, we would perhaps find that the true stationary life-cycle earnings profiles are the dotted curves (G_{12}) and (G_{22}). These are drawn parallel to the initial ones with a smaller earnings differential between more and less educated workers. However, this differential will possibly be larger than the one which was observed between points J_{11} and J_{21} 15 years before, in accordance with one of the arguments made in the previous section.

The lessons to be drawn from that simple example are thus rather negative. The observed change in educational returns estimated from two repeated cross-sections may over-estimate or under-estimate the long-run change, whether we consider the whole population or only the youngest cohorts. The interpretation to be given to this kind of evidence, as collected for instance by Psacharopoulos (1988) for a few countries, is thus rather ambiguous[11]. It is still more so when one takes into account the possibility of short-run variations in the structure of earnings induced by cyclical macro-economic movements.[12]

As argued before, changes in the educational structure of earnings may also reflect variations in the mode of selection into the schooling system of the cohorts observed in the labour market. The situation is here worse than in the illustrative example given above because, in most countries, it is unlikely that comparable data sets be available where present

11. Among the developing countries listed in Psacharopoulos (1988), the only apparently significant drop in the returns to education is observed for Colombia.

12. See Freeman (1979).

earnings as well as family characteristics and ability at the time the schooling decision was made about a given individual would be observed.

3. Pseudo-panel analysis of schooling and earnings

Ideally, complete panel data on a reasonably long period would be necessary to answer most of the questions raised in the preceding sections. Such data are not available in developing countries or are very limited. However, many developing countries have conducted household surveys on a regular (yearly or quarterly) basis over the last 15 to 20 years. Using those repeated cross-sections as pseudo-panels should permit considerable progresses to be made in the understanding of educational development and its relationship with the labour market. Those surveys are most often designed according to the ILO labour force survey format and provide in general fully comparable data on family composition, individual educational levels, occupation -- including schooling for children -- and earnings.[13] We indicate in what follows several research directions based on these extremely rich data sets, which as yet are far from fully exploited.

The first type of analysis is a simple description of the dynamics of the labour market. It consists of following over time successive cohorts of individuals and to examine the evolution of their educational structure, their mean participation rate to the labour force, their occupational structure, and the mean and dispersion of their earnings by educational level. As formal education is scarcely modified once people have left school, all that is needed is to analyze in successive surveys the characteristics of all individuals borne at a given time. It is important to work with full distributions rather than with the 'mean' representative individual of a given cohort and a given educational group. This is because some labour market phenomena related to the educational transition may affect the dispersion, rather than the mean of the relevant economic variables. This is true, in particular, of the various selection mechanisms analyzed above.

Repeated cross-sectional surveys also give the possibility to analyze the dynamics of the selection into the educational system. At each point in time, one may observe the occupational distribution of children of a given age in relation with the characteristics of the households they belong to. On that basis, it is possible to put into evidence how the private demand for schooling, or the operation of the rationing system, is changing over time. In particular, one may determine the characteristics of the households which are responsible for the marginal increase in observed enrolment rates at the various schooling levels, and compare them to the characteristics of families with children in or out of school.[14] Of course, the only schooling determinants available in household surveys are family characteristics, so that this description of the selection into the schooling system will leave aside some potentially important personal characteristics like ability. Even with that limitation, however, such a dynamic analysis of the evolution of the structure of school enrolment should

13. See the list of available surveys collected by ILO (1986).

14. Although a difficulty may arise with the latter because children out of school at a given age may well have left their families.

represent a significant improvement in comparison with our present knowledge in this matter.

The next research steps are more analytical. In accordance with the general theoretical framework sketched in the preceding sections, the objective would be to 'explain' the observed evolution of earnings on the basis of both the supply and the demand side of the labour market. On the supply side, the objective would be to investigate the relationship between observed structural changes in school enrolment and those in the structure of earnings observed a few years later, after the cohorts under analysis entered the labour market. Likewise, on the demand side, it should be possible to analyze the degree of substitution between labour of distinct educational types and work experiences, whereas controlling for fluctuations in the level and the structure of macro-economic activity.

Available series of household surveys might not be long enough to get into the estimation of a complete dynamic model of the labour market and its various segments, as defined by individual educational levels and work experience. However, very much may be learned with 10 to 15 annual cross-sections about the heterogeneity of the labour market and interactions between short-run adjustment and long-run equilibria. This only requires a careful analysis of the observed changes in earnings differentials across educational and age groups in relation with variations in the size and the educational structure of the cohorts of workers present in the labour market, and with variations in the level of activity of the various sectors of the economy.

Another research direction would then be to examine whether changes in the educational structure of earnings and occupations of previous cohorts which have already been in the labour market for a few years affect current schooling decisions in households, and, if so, how they may modify the educational structure and other characteristics of future entrants in the labour market.

Undoubtedly, a research programme based on a systematic exploitation of repeated cross-sectional labour force surveys which are accumulating in an increasing number of developing countries is extremely promising.[15]. In the absence of comprehensive panel data sources, it should permit to bridge some major gaps in our understanding of how the labour market discriminates among educational levels and age groups, and how the selection into the schooling system operates and changes with the development process. In countries where they presently are available, these data sources also provide a permanent assessment of what is going on the educational front, which is incomparably richer than traditional school enrolment statistics and fully incorporates the labour market aspect of education. Needless to say, such a research programme is ambitious. Manipulating several surveys with several thousands of observations each is a serious, and possibly costly undertaking. It would clearly be a more costly mistake to simply ignore the enormous amount of information which is contained in these data sources and which may greatly improve our knowledge of the role of education in the development process.

15. Several studies of that type are already available for developed countries: Klevmarken (1972, 1976), Welch (1979), Freeman (1984), Mingat and Jarousse (1986), Baudelot and Glaude (1989) among others. We are not aware of such a systematic exploitation of repeated household surveys in developing countries.

Chapter III

Externalities linked to educational development

The first part of this paper has essentially focused on the productive role of education at the individual level, that is by how much do individual earnings rise when the number of years of schooling increases. We have seen how difficult it is to answer this question in a country at a stage of rapid educational development. From a public, or collective point of view, however, it is not sure that such a measure of the returns to education is fully relevant. On one hand, there is the old problem of knowing whether earnings differentials related to education truly reflect differences in labour productivity.[16] Even if it were the case, on the other hand, it would remain to check to what extent the collectivity may derive gains from individual education which are not reflected in earnings differences. In both cases, estimates of private returns to education would not coincide with public returns, even after accounting for the public provision of educational services. Such a discrepancy would also justify why it would be inefficient to rely purely on the private initiative in the educational field, apart from the necessity of correcting obvious capital market imperfections which may prevent able children to get the efficient level of schooling.[17]

Externalities linked to education may be of different types. The recent literature on endogenous growth insists upon production externalities whereby the same amount of human and physical capital yield a larger output in societies with a higher average educational level. A brief summary of the assumptions found in that literature and their implications is given in the first section of this part of the paper. One may think of other externalities, however, the most often quoted ones being the reduced fertility of more educated women,[18] the ability to adapt quickly to a changing environment and make technical innovations, or the enhanced national cohesion and democratic sense of a more educated population. Of course, it is difficult, if not impossible to quantify in economic terms most of these effects. It is not even sure they can effectively be put into evidence.

The remaining of this paper thus addresses issues linked only to purely productive externalities, the fundamental issue being that of identifying them empirically. Two research directions are investigated. The first one relies on the well-known Solow-Denison macro-economic growth accounting framework. The second tries to exploit micro-economic data, in particular those related to the rural sector of developing countries where earnings differentials, and changes in them, may be thought to reflect more accurately true differences and changes in labour-productivity.

16. The early analysis of that question by Blaug (1972) is still valid.

17. For a general analysis of these 'non-monetary' benefits from education, see Azariadis and Drazen (1988).

18. See S. Cochrane (1987) for instance.

1. The endogenous growth framework

Endogenous growth models may be seen as a revival of the classical thinking about growth where a prominent role was given to economies of scale and externalities. This role had been totally forgotten in the 'neo-classical' literature, where growth was predicted to converge toward some 'steady state' given by the growth rate of the labour force and some exogenous rate of technical progress.[19] In the long-run, growth in these models thus is completely exogenous, that is independent from the initial conditions of the economy and the behaviour of economic agents.

Following the pioneering work by Romer (1986) where public knowledge of private innovations and R&D investments makes long-run growth endogenous, Lucas (1988) presented a model where technical progress results from an externality linked to human capital and education. Each individual worker (or family) invests in training (or children education) being unaware that, by doing so, he/she increases not only his/her own productivity but, by contributing to a rise in the average educational level of the population, also that of other workers (even those who do not invest in education), and of other production factors. Steady growth then depends on individuals' human capital accumulation behaviour. As each individual ignores the positive externality he/she produces, the resulting equilibrium growth path is inefficient. State subsidies to education may correct for that inefficiency and enhance the long-run potential of the economy.[20]

The endogenous growth literature is obviously quite successful in explaining why long-run growth *could* differ across countries because of a heterogenous accumulation behaviour of technical knowledge or human capital, and related externalities. However, little evidence is given, if any, of the relevance, existence and size of such externalities. From that point of view, endogenous growth models are based on hypotheses that, although intuitively appealing, remain almost entirely to be verified. The mechanics of these models appear to a large extent more important than the mechanisms themselves. Lucas (1988), for instance, spends relatively little time justifying the educational externality, referring altogether to more efficient communication, faster adaptation to technological changes, and other unspecified factors.

An aspect of educational externalities which has been rather actively researched by several disciplines is the ability of more educated individuals to adopt technical or organisational innovations. The widely quoted paper by Schultz (1975) bears upon that aspect. However, whether this is a true externality or whether all gains from a faster adaptation to a change in their environment are appropriated by the individuals themselves may be debated.

On purely intuitive grounds, all these explanations might well be valid. But the issue at stake seems too important for the analysis to rely on such an abstract and intuitive views.

19. One of the first and clearest exposition is that by Solow (1956). Note, though, that the asymptotic rate of growth is not necessarily exogenous in growth models where, unlike in the original formulations, savings come from a rational infinitely lived agent. See Jones and Manuelli (1990).

20. Azariadis and Drazen (1988) present a model close to that of Lucas, where, because of 'threshold' externalities of education, multiple growth paths arise.

Some empirical investigation is crucially needed, on the basis either of existing micro- and macro-data, or of new data sets to be developed. We explore in what follows several research directions which could permit to give a little more empirical content to the preceding theoretical considerations.

2. Direct and indirect contribution of education in a macro-economic growth accounting framework

The principles of growth accounting, directly inspired from Solow's (1956) formulation of the neo-classical model of growth may be summarized as follows. Consider the simple case of a constant returns to scale technology with only two factors of production: K, for physical equipment, and L for labour. Total output, Q, is given by:

$$Q = F(K,L)\, e^{at} \qquad \text{(II.1)}$$

where F( ) is a conventional constant returns to scale production function and a is the rate of (neutral) exogenous technical progress, ensuring, rather artificially, that with constant amounts of equipment and labour, output will grow at the rate a. Taking derivatives and switching to growth rates -- denoted by δ -- we get:

$$\delta Q = (KF_K/Q)\, \delta K + (LF_L/Q)\, \delta L + a \qquad \text{(II.2)}$$

where F_K and F_L are respectively the marginal product of equipment and labour. If the economy is assumed to be competitive, the real remuneration rates of the two productive factors are equal to their marginal products. The growth decomposition equation (II.2) then becomes:

$$\delta Q = S_K\, \delta K + S_L\, \delta L + a \qquad \text{(II.3)}$$

where S_K and S_L are respectively the share of capital and labour in GDP. In a rough way, this equation provides the basis for growth accounting over a relatively short period of time. δK, δL and δQ are observed. Combining the first two growth rates with factor shares permits to identify their contribution to the growth rate of output. That of technical progress, a, is then found as a residual.

The work by Solow (1957), Denison (1962), Griliches and Jorgenson (1967), Carre, Dubois and Malinvaud (1968) along these lines is well-known. In addition to the basic factors above, several corrective terms are generally introduced -- the most important ones being the utilization rate of existing equipment, and the average annual number of work hours by labour force participants -- and additional factors are accounted for: human capital, in particular, as measured by the total number of years of schooling of the labour force.

In the line of the endogenous growth models discussed above, we want to analyze here whether it is possible to distinguish, in this growth accounting framework, the 'direct' contribution of education to growth, corresponding to privately appropriated returns, and some 'indirect' contribution corresponding to the externalities put into the forefront by the

endogenous growth literature. Under the assumption of a fully competitive determination of the rate of return to productive factors, a possible way of identifying this externality would be the following.

Consider the case of three factors: physical equipment (K), raw labour (L) -- that is the total number of workers -- and human capital (H), measured by the total number of years of schooling on top of the minimum observed for unskilled workers.[21] Assume that the production function in the economy is given by:

$$Q = F(K,L,H;b).E(H/L;c).e^{at} \qquad (II.4)$$

where F( ) is, as above, a conventional constant returns to scale production function with some pre-specified functional form parametrized by the set of coefficients b, a is the neutral rate of technical progress, and E( ) is the production externality linked to the average educational level of the labour force. As for F( ), an arbitrary, but flexible, functional form is selected which is parametrized by the set of coefficients c.

As those individuals who possess (or acquire) human capital are not aware of the positive externality they create for the whole economy, the competitive distribution mechanism is solely based on the 'private' production function F( ). Under these conditions, regressing δQ, as before, on δK, δL and δH yield regression coefficients (or functions) which, unlike in the previous model, should be different from factor shares. It is that difference which should permit to identify the externality E( ).

More precisely, taking the first derivative of (II.4) and switching to growth rates yields:

$$\delta Q = (KF_K/Q).E.\delta K + (L(F_L E - HFE_h/L^2)/Q).\delta L + (H(F_H.E + FE_h/L)/Q).\delta H + a \qquad (II.5)$$

where E_h is the derivative of E with respect to H/L. As before, the factor shares of equipment (S_K), raw labour (S_L) and human capital (S_H) are given, under perfect competition, by:

$$S_K = K.F_K/F \; ; \quad S_L = L.F_L/F \; ; \quad S_H = H.F_H/F \qquad (II.6)$$

Clearly, if E_h is different from zero, i.e. there is an externality, the coefficients of factors' growth rates in (II.5) will differ from the factor shares in (II.6). Testing the existence of an externality linked to education, under the assumption of fully competitive factor markets, is thus equivalent to test whether the coefficient of each factor's growth rate in (II.5) is significantly different from its share in (II.6).

The empirical methodology to estimate the various productive factors and their shares in GDP is well known.[22] The test proposed here thus consists of estimating the four equations

21. The model could then be extended to take into account additional components of human capital -- job experience, for instance.

22. For a recent application to the measurement of the contribution of education to US growth, see Jorgenson and Fraumeni (1990).

in (II.5) and (II.6), under some assumptions about the functional forms of F( ) and E( ), and of testing some cross-equations restrictions. If the share functions (II.6) behave empirically in a way significantly different from the coefficients of factor growth rates in the growth accounting equation (II.5), then either there exists an externality or the competitive assumption behind the whole model does not hold.

The difficulty of undertaking such an analysis must not be understated. For a given country, it would require that data on factor supplies and factor shares be available on an annual basis for a rather long period, say 25 years or more. If this is conceivable for physical equipment -- ignoring the well-known measurement problems for that variable -- and raw labour, it is much less so for education. On the other hand, as discussed at length in the first part of this paper, the assumption of a competitive determination of the returns to education may be quite restrictive on a year to year basis in a country undergoing a major educational transition. Under these conditions, the test suggested above may well be inconclusive as to whether education is a powerful source of externality in the growth process or whether competitive equilibria are extremely slow to establish.

A less exigent method would consist in comparing the coefficients of the growth accounting equation (II.5), taken to be constant over a limited period of time, not to the annual evolution of factor shares but to their average over the estimation period. Assuming that, over such a period, all factor markets are on average approximately at equilibrium, any discrepancy could again be interpreted as the effect of some externality.

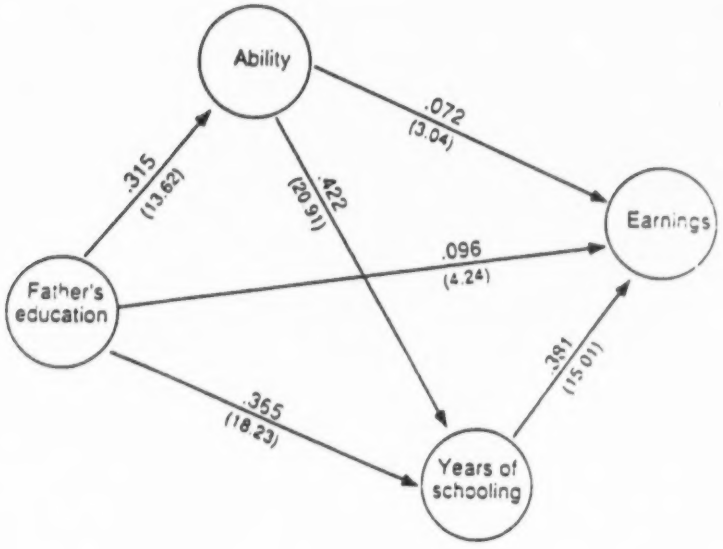
3. Identifying educational externalities at the micro-economic level

At a micro-economic level, an educational externality would correspond to individuals living or working with more educated persons securing for themselves higher incomes from apparently identical activities.

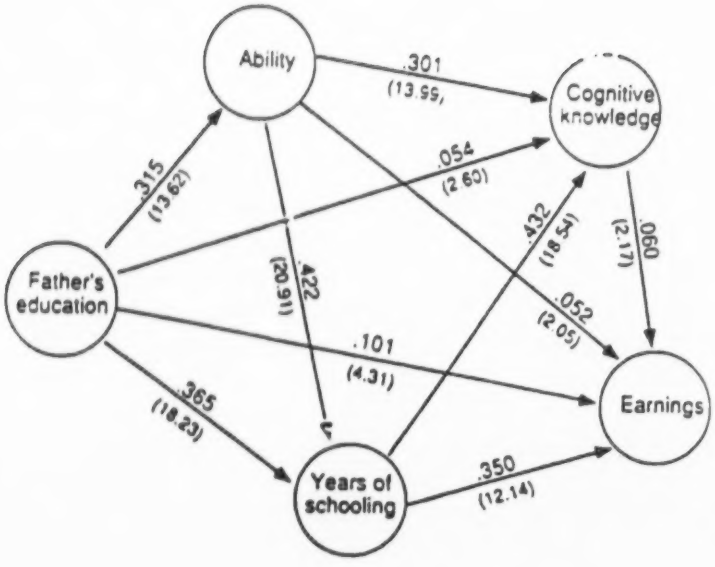
A good example of such a potential externality, and again of the ambiguity of empirical evidence in that field, is provided by the conventional 'path' models of education. As seen in the first part of this paper, these models explain in some sequential or simultaneous manner the ability, the level of schooling and the earnings of an individual as a function of his/her social background, including the educational level of parents. Focusing on the latter variable, one may see in the structural model (I.2)-(I.5) and the empirical application shown in *Figure 3* taken from Psacharopoulos and Velez (1990) that its effect on the earnings of a child is twofold. Directly, an individual with given characteristics, including education, and more educated parents earns significantly more than an individual with the same characteristics but less educated parents. Indirectly, the level of education of parents partly determines the schooling level of children, which in turn partly determines their earnings.

Figure 3. Empirical application

PANEL A



PANEL B



Source : Psacharopoulos, G.; Velez, E. (1990).

Various interpretations may be given to that empirical fact. The most commonly found in the literature is that of social screening. Other things equal, more educated parents have the capacity of promoting their children up in the social ladder so as to guarantee them higher earnings. Thus, in an imperfect labour market, the direct effect of parents' education on the earnings of their offspring would not necessarily correspond to a higher productivity of children. On the other hand, one may also take exactly the opposite view, namely that the labour market is perfectly competitive in the long run and that the extra earnings that the children get from educated parents -- i.e. on top of the direct return to their education -- truly reflect a higher productivity transmitted directly by the parents, instead of indirectly through having sent their children to school.

The second case would clearly correspond to a productive externality of education. In such circumstances, by increasing the educational level of an individual, the collectivity is gaining not only through the direct rise in his/her productivity but also through the future rise in the productivity of his/her children. A measure of the social return to education based only on the first effect would then be under-estimated. A correct measure should also include the (discounted) increase in the productivity of the second generation.

Given that possibility, the issue is twofold. First, is it possible to test whether the direct effect of parents' education on children' earnings truly reflect a productivity gain, instead of a competitive advantage in an imperfectly competitive labour market? Second, is it possible to identify similar but 'faster' externalities across individuals belonging to the same generation?

There has been an intense debate in the 1970s about whether higher returns to education reflect productivity-enhancing effects or screening practices -- see Blaug (1972), Layard and Psacharopoulos (1974), for instance. The conclusion is not clear-cut and one may doubt whether a clear conclusion will ever be reached. Much less has been written about the direct effect of parents' education on children' earnings so that one may expect still more ambiguity on that issue. In both cases, however, restricting the analysis to cases where productivity can be directly observed, instead of being imputed from the observation of earnings determined through the complex mechanisms of the labour market, should lead to more convincing conclusions. As stressed by Jamison and Lau (1982), this is the reason why an analysis of the returns to education in the farm sector of developing countries is so important. When comparing yields and output mixes between two family farms which differ only by the educational level of their members and thus use the same land and the same amount of equipment and inputs, one may feel relatively secure that yields or income differentials reflect pure productivity effects. Indeed, a substantial part of the literature on education in developing countries bears precisely on that subject. The same should apply to estimates of the direct effect of parents' education on children' output and income in the farm sector.

If there are numerous studies on the demand for education which emphasize the role of parents' schooling achievements, and as many studies on the relationship between education and farm productivity, a cursory review of the literature seems to indicate that few empirical analyses integrate both aspects. Most of the earning models including parents' education in

the determination of both individual schooling and earnings appear to concentrate on the urban labour market, where the nature of that relationship is a priori ambiguous. It would certainly be of great interest to apply the same framework to farm families and this should rank high in research priorities.

As mentioned before, applying the same methodology to the urban labour market raises the question of whether observed earnings reflect productivity or not. At a relatively low educational level of both parents and children, it seems unlikely that the social screening effect on earnings be very strong. If it is present, on the other hand, it might be possible to correct for that effect by a careful treatment of the (apparent) self-selection of young workers in some specific sectors of the labour market. For instance, a more educated father may give access to the modern sector of the economy to his children, whereas, children with the same level of education but non-educated parents may find it more difficult to enter that sector. It would be of interest to know how much of the apparent externality between parents' education and children earnings remains when this selection is accounted for.

It seems more difficult to use the same approach to test for a possible externality across individuals belonging to the same or neighbouring generations. The idea here is that, other things equal, the productivity of poorly educated individuals should be higher if they work or live in an environment where there is more educated people. However, since their earnings, when determined by competitive mechanisms, cannot reflect that advantage, individual productivity levels should be directly observed. Note, in this respect, that the situation is different from that considered before of farm families where the overall productivity of the farm is what matters. In the present case, testing that individuals working for or with a more educated farmer are more productive requires observing individual productivities. This cannot be done on the basis of commonly available data, although it would be possible to design specific surveys which would permit to conduct such a test.

If it is assumed that earnings truly reflect productivity in the urban sector of the economy, the preceding argument would lead to test whether, other things equal, the wage rate of individuals with a given minimum amount of schooling increases with the average educational level of workers in the firm they work in. We are not aware of such attempt in the literature.

Chapter IV

Summary and conclusion

In this paper we have investigated several research directions in which our understanding of the role of education in the development process might be improved. They all concern the productive aspect of education and the way it is accounted for in the labour market. The basic idea throughout the paper is that the conventional way of measuring private and public returns to education may be unsatisfactory, either because it is based on some stationary equilibrium assumption of the labour market or because it ignores possible productive externalities of the development of education.

In most countries, available data do not permit a detailed exploration of the second issue at the micro-economic level. It seems important, however, to keep in mind the questions that were addressed in this paper when designing new surveys aimed at evaluating the effects of education. Although a priori less precise and less conclusive, a macro-economic approach along the lines of growth accounting exercises might also yield some interesting results at a rather low cost.

Concerning the measure of rates of return to education in a period of educational transition, this paper has shown the important analytical potential which lies in the availability in many countries of repeated cross-sectional surveys on earnings, occupation and schooling. This potential has been very little exploited until now. It certainly requires some heavy data manipulation, but the data are available and it would be costly to ignore them and to concentrate only on the collection of new and possibly better data.

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Issues and methodologies in educational development, N° 2

The analysis of dynamic "swings" in the rates of return to education and other life cycle investments is both of great theoretical and public policy concern. Education, following the human capital approach plays a major role in both the development and the growth processes: upon the labour market as a determinant of current and life cycle labour income, of labour supply, and as well in other related household decisions (fertility, intergenerational transfers). An accurate assessment of this role would provide strong guidelines to policy makers in deciding the comparative advantage of "investing in education" versus other growth and welfare increasing investments. The issue is particularly pungent in LDCs in which scarce resources are to be allocated. Most of the empirical research conducted in the last decades has been based on cross sectional analysis with the implicit assumption that both the market for education and for educated labour are permanently in equilibrium. This results in "rubbing" out the dynamic perspectives associated with education. This paper reflects upon the relaxing of these rather strong assumptions on the dynamic pattern of both social and private returns to education. Several issues are dealt with somewhat informally: selection in the educational system and its possible biases on private returns to education, limited short and medium run substitutability between less and more educated workers and its sequels on shifts in the rates of return, finally one considers the growth externality generating properties of education and investigate their possible determination at the microeconomic level.

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